

**U.S. FISH AND WILDLIFE SERVICE  
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Echinomastus erectocentrus* var. *acunensis*

COMMON NAME: Acuña cactus

LEAD REGION: Region 2

INFORMATION CURRENT AS OF: April 2010

**STATUS/ACTION:**

☐ Species assessment – determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: October 30, 2002

☐ 90-day positive - FR date:

☐ 12-month warranted but precluded - FR date:

☐ Did the petition requesting a reclassification of a listed species?

**FOR PETITIONED CANDIDATE SPECIES:**

a. Is listing warranted (if yes, see summary of threats below)? Yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes

c. If the answer to a. and b. is “yes”, provide an explanation of why the action is precluded.

Higher priority listing actions, including court-approved settlements, court-ordered statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The “Progress on Revising the Lists” section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

☐ No Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): 7/1/1975

☐ Candidate removal: Former LP: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

☐ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a

proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

- ☐ F – Range is no longer a U.S. territory.
- ☐ I – Insufficient information exists on biological vulnerability and threats to support listing.
- ☐ M – Taxon mistakenly included in past notice of review.
- ☐ N – Taxon does not meet the Act’s definition of “species.”
- ☐ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Plant, Cactaceae

LAND OWNERSHIP: The acuña cactus is found on lands managed by the U.S. Bureau of Land Management (BLM), National Park Service at Organ Pipe Cactus National Monument (OPCNM), Arizona State Land Department, Department of Defense lands (Barry M. Goldwater Gunnery Range), and private lands. There are an estimated 1,000 acres of area where acuña cactus have been found in OPCNM (Rutman 2007, p. 1). We have no numbers of acres from the other land management agencies.

LEAD REGION CONTACT: Sarah Quamme, 505-248-6419, [Sarah\\_Quamme@fws.gov](mailto:Sarah_Quamme@fws.gov)

LEAD FIELD OFFICE CONTACT: Mima Falk, Arizona Ecological Services Field Office, Tucson sub-office, 520-670-6150 ext 225, [Mima\\_Falk@fws.gov](mailto:Mima_Falk@fws.gov)

#### BIOLOGICAL INFORMATION:

##### Species Description

*Echinomastus erectocentrus* var. *acunensis* (Acuña cactus) is a small spherical cactus, usually single-stemmed, that can be up to 40 centimeters (cm) (16 inches (in.) tall. The *Echinomastus erectocentrus* var. *acunensis* has maroon to mauve-colored up-turned central spines. The plants have 11-15 radial spines up to 2.5 cm (1 in.) long and 3-4 central spines up to 3.5 cm (1.4 in.) long). The plant flowers in early spring (March), and produces rose, pink, or lavender flowers which are 5 cm (2 in.) long. The fruits are pale green, 1.25 cm (0.5 in.) long, containing black seeds (Arizona Rare Plant Committee 2001).

##### Taxonomy

This species was originally described in 1953 by W. T. Marshall as *Echinomastus acunensis* (Marshall 1953, pp. 33-34). It is known by many synonyms, including *Sclerocactus erectocentrus* var. *acunensis* (Coulter) Taylor and *Neolloydia erectocentra* (W. T. Marshall) var. *acunensis* L. Benson (Arizona Game and Fish Department (AGFD) 2004, p. 1). The Cactaceae treatment in the Flora of North America (Zimmerman and Parfit 2003, pp. 194-195) recognizes the species as *E. erectocentrus* var. *acunensis*. The other variety, *E. erectocentrus* var. *erectocentrus*, is also recognized as a valid taxon in the Flora of North America. The two varieties are generally considered to be morphologically distinct and geographically isolated, but there have been questions regarding the morphology of some individuals (AGFD 2004, p. 6). To address those concerns, we funded a section 6 project to analyze morphological distinctness of the two varieties, which was completed in January 2007. The evidence suggests that there are

four empirical in-groups representing four infraspecific taxa. The conclusion of the morphological work was that the two varieties are distinct (Baker 2007, pp. 19-21), and we conclude that *Echinomastus erectocentrus* var. *acunensis* and the needle-spine cactus taxa are valid. Baker (2007, p. 20) recommended nomenclatural changes, based on the International Rules of Botanical nomenclature, but formal name changes were not proposed in this study. A taxonomic key is part of the study, using the current names.

### Habitat

*Echinomastus erectocentrus* var. *acunensis* is known only from well-drained gravel ridges and knolls on granite soils in the Arizona Upland subdivision of the Sonoran Desert scrub association at 365 to 850 meters (m) (1,198 to 2,789 feet (ft)) in elevation (Phillips et al 1982, p. 4; Arizona Rare Plant Committee 2001).

### Historical and Current Range/Distribution

Populations are known from Pinal, Maricopa, and Pima counties in Arizona and from Sonora, Mexico (AGFD 2004, p. 2) (Figure 1). Plants are known from OPCNM, Ajo, and the Coffeepot Mountains (BLM) in western Pima County, Arizona, Sand Tank Mountains (BLM) in Maricopa County, Mineral Mountain (BLM) in Pinal County, on State and private land in Pinal County, Arizona, and Sonora, Mexico (Rutman 2007 p. 1). We have no information to indicate that the current range of this species differs from the historical range, with the exception of the location in the Sand Tank Mountains, which was recently discovered (Rutman 2000, p. 1).

### Population Estimates/Status

Coffeepot Mountain: The BLM (Phoenix District) established three 20 x 50 m (66 x 164 ft) monitoring plots in the early 1980s. Three hundred and ten living plants and 332 dead plants were counted inside and outside of the plots (Rutman 1987 p. 2). BLM staff reported a “precipitous decline” of this population in 1989 (Johnson 1989 p. 1). These plots have not been inventoried since the early 1990s. Data have not been analyzed. Many old and new standing carcasses were observed in May 2007 (U.S. Fish and Wildlife Service (Service) 2007, p. 1).

OPCNM: Two 20 x 50 m (66 x 164 ft) permanent monitoring plots were established in 1977. Between 1977 and 1981, there was 31 percent mortality in the plots (Phillips and Buskirk 1982, p.2). Two more plots were added 1983 and two more in 1988. From 1988 through 1991, the population was thought to be stable or increasing (Johnson et al 1992, p. 172). From 1993 through 2005, annual mortality was variable, but exceeded recruitment in all years (Holm 2006, p. 2-2). The highest observed mortality, 49 percent, was in 1996 when large numbers of plants were found uprooted (Holm 2006, p. 2-6). Similar episodes were observed in Coffeepot Mountain and the town of Ajo populations (Rutman 2007, p. 3). The total number of plants in the 6 plots at OPCNM has declined from a high of 446 plants in 1991 to 48 plants in 2007 (Rutman 2007, p. 3). The Service plant ecologist and OPCNM botanist were able to visit the plots on March 27, 2008. There were only 23 plants left on the plots, with no recruitment in any of the plots. Sixty plants were found outside of the plots, but those were located around the first two plots. There were no plants found outside the four remaining plots, which have 2-5 plants remaining in each (USFWS 2008a, p. 1).

Ajo: The isolated population at Darby Wells was first reported by Heil and Melton (1994, p. 14).

Fewer than 10 plants were found at this site in 2007 (Rutman 2007, p. 4). On Indian Village Hill there were 102 plants in 1996 when it was first recorded (Rutman 1996, p. 1). In 2007, only 40 plants were found (Rutman 2007, p. 4). There are two other populations in Ajo, on weather tower hill, and east of the Ajo mine pit. There were 16 live and 19 dead plants on weather tower hill in 2006 and 7 living plants and 3 dead plants east of the mine in 2006 (Rutman 2006, p. 2).

Ninety-Six Hills/Box O Box Wash: This population is in the vicinity of Florence. Parfit (1977, p.1) noted that *Echinomastus erectocentrus* var. *acutensis* was “common but very localized” and, that, with the exception of livestock grazing, “no noticeable use” of the habitat was occurring. Many plants, of various ages and sizes, were noted, and many dead plants. Engard (1977, p.1) noted the presence of “many seedlings and mature plants” and also that the plants were “abundant locally.” Rutman (1988, p.1) found 29 live plants and 6 dead plants in a 2-hour survey in the same general area. Breslin (2008, pp. 3-5) reported that in over 60 hours of survey effort in the area he had located 45 plants, 1 seedling, and 17 dead plants. On March 20, 2008, the Service plant ecologist found 11 live plants and 10 dead plants in a 3-hour survey. In the same general area, C. Butterworth (2008, p.1) found 32 live plants, of various sizes, except seedlings. He noted that “seedlings were very noticeably absent.”

Mineral Mountain: Plants were collected by Hart (1992) from BLM lands (BLM 1993, p.1). There were no details of the number of individuals seen, just a map with 3 locations. On September 10, 2008, the USFWS plant ecologist and BLM State Botanist (John Anderson) visited this area to check on the status of the plants. Anderson had visited this site in the late 1990's and had estimated that there were approximately 100 individuals scattered along three ridgelines (Service 2008c, p. 1). During the 2008 visit, we searched the area and found less than 20 plants and saw many dead plants. There were no young plants, and we only found one individual with fruit. We did not do a systematic survey and did not have time to hike up to the third ridge, but we did spend considerable time searching the other two ridges (Service 2008c, p.1).

Sauceda Mountains/Ryan Canyon: Rutman (2006, p. 2) visited these small populations, estimated to be between 50-100 plants. She noted that they are located either on the Barry M. Goldwater Gunnery Range or on BLM lands.

Sand Tank Mountains: Rutman (2006, p. 2) noted two small populations, with 50-100 individuals in each. The total habitat was estimated to be less than 0.5 acre.

Sonora, Mexico: Felger (2000, p. 208) noted the occurrence of this species 2-11 miles (mi) (3-18 kilometers (km)) southwest of Sonoyta, on granitic soils on hillsides and alluvial fans of gravelly soils. We have no information on population size or the amount of habitat.

## THREATS

### A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Habitat loss and degradation. Several populations occur on private land in the vicinity of Ajo and Florence, Arizona, and in Sonora, Mexico. The only population where access is readily

available is Ajo. The total amount of habitat there is less than one acre (Rutman 2007, p. 1). All of the sites in the Ajo area are littered with broken glass, crossed by old roads, and surrounded by development. These populations have been in decline since 1996, when site visits began. It is likely that, given the high level of site use, these populations will continue to decline and possibly disappear within the next few years. There has been no evidence of recruitment in any of these populations. We have no information on locations of *Echinomastus erectocentrus* var. *acunensis* on private lands near Florence. The populations in the Ninety-six Hills area are scattered across State and private lands. There have been no systematic surveys in this area and the sites that are visited are all on State lands. Some residential growth is in the surrounding area, but the populations of *E. erectocentrus* var. *acunensis* seem remote and little to no human activity or off-highway vehicle use were observed (Service 2008b). Thus, there were no obvious threats to the habitat located in the Ninety-six Hills area (Service 2008b). Little is known about the populations in Mexico. The plants are scattered across low granite hills near Sonoyta, Mexico. Likely threats to habitat are from the expansion of Sonoyta and the increased immigrant traffic near this border town. Both of these activities may destroy habitat (in the case of town expansion) or degrade habitat. There is much car, truck, and human traffic going back and forth across the border, and habitat degradation is likely because the habitat offers no restrictions to vehicle and pedestrian traffic. There was no evidence of damage to *E. erectocentrus* var. *acunensis* habitat at OPCNM (Service 2008a) or at Coffeepot Mountain (BLM) (Service 2007). There were a few pedestrian (smuggling) trails observed near the OPCNM monitoring plots, but none that posed a threat to plants or habitat.

Livestock grazing. No livestock grazing is allowed within the boundaries of OPCNM or on BLM lands where *Echinomastus erectocentrus* var. *acunensis* are found. However, grazing does occur on State trust lands near Florence where *E. erectocentrus* var. *acunensis* is present. Signs of cattle were observed during the Service's March survey (Service 2008b, p.1), suggesting heavy grazing. Previous surveyors (Rutman and Parfit) noted livestock use in the area. Livestock can step on and knock over plants and may modify the habitat by compacting the soil. This compaction could impede germination. The Service ecologist observed that at least 6-7 of the dead plants observed could have been knocked over by livestock (Service 2008b, p.1). In the Saucedo Mountains/Ryan Canyon area, Rutman (2006, p. 2) noted that there was a large population of fountain grass (*Pennisetum setaceum*) less than 0.5 mi (0.8 km) away and burros were seen in that area.

Occasionally, wild burros are reported in the Coffeepot Mountain/Ryan Canyon area (Rutman 2006, p. 2). It is not known how wild burros may affect *Echinomastus erectocentrus* var. *acunensis* or its habitat, but it is possible for burros to step on or kick over plants.

Law enforcement activities. *Echinomastus erectocentrus* var. *acunensis* populations are within areas that receive attention by the U.S. Border Patrol and Park Rangers. At OPCNM, the plants occur in an area that is closed to visitors, and OPCNM staff cannot access the area without law enforcement personnel accompanying them. The OPCNM botanist was escorted by law enforcement and granted access to the monitoring plots on March 27, 2008. Law enforcement officials have identified this area as "hot" for smuggling and have discouraged access to the monitoring plots located in this area. Due to this, monitoring of these plots has been difficult and future access to the site remains unknown. To date, the Border Patrol has stayed on the roads

and there was little evidence of habitat degradation from patrol work in OPCNM. However, there were several areas away from the plots where Border Patrol vehicles had driven off the roads (Service 2008a, p. 1). Immigrant and smuggling routes are changing constantly within OPCNM, and it is difficult to predict whether the *E. erectrocentrus* var. *acunensis* populations will be affected by off-highway vehicle use in the future. Plants and habitat could be trampled on or driven over, and under the current circumstances, years may go by before the populations can be monitored.

Invasive species. Rutman has observed patches of highly invasive *Pennisetum ciliare* (buffelgrass) and *P. setaceum* (fountain grass) near *Echinomastus erectrocentrus* var. *acunensis* populations (Service 2008a, p. 1). OPCNM attempts to control the spread of these species by having volunteers pull up the plants, but volunteers cannot access the backcountry for safety reasons, so proliferation of the invasive species populations is likely in the future. These two grass species threaten *E. erectrocentrus* var. *acunensis* and its habitat by competing with native vegetation for resources, primarily water. They also increase the risk of wildfire because these grasses form dense stands that dry, producing a continuous fine fuel layer that readily burns (Búrquez-Montijo et al 2002, p. 138-140). Sonoran desert vegetation is not adapted to fires and is killed, modifying the habitat permanently. *E. erectrocentrus* var. *acunensis* is destroyed by wildfire, and its habitat may become modified to such an extent that recolonization would not occur.

Mining. A very large open-pit mine exists in Ajo which is currently closed, and has a very low likelihood of the mine re-opening. The small populations of *Echinomastus erectrocentrus* var. *acunensis* that remain in Ajo have been part of a much larger population that occurred before mining activity began, but there are no survey records for this species in the area prior to mining activity. Rutman (2006, p. 1) noted that habitat was lost when Indian Hill Village road was built. Rutman (2006, p.1) further noted that occupied habitat may also have been lost where the following now occur: Assembly of God Indian Mission, New Cornelia mine, parking lot for the mine lookout, baseball diamond, and the large informal parking lot to the north of the hill. It is possible that this population was at one time connected with the few plants to the east of the open pit mine. Therefore, we do not consider mining activity a current or future threat, but note that habitat and plants were probably destroyed when the mine was active, thereby diminishing the size and range of the Ajo area population.

In summary, there are on-going activities that threaten *Echinomastus erectrocentrus* var. *acunensis* with habitat loss and modification. Habitat destruction and degradation is on-going in Ajo, but the extent to which it is contributing to the observed mortality in the populations cannot be quantified. There are probable threats to the habitat from development in Mexico, but data are lacking to quantify this threat. Observations of livestock use near the Florence populations may have caused mortalities of *E. erectrocentrus* var. *acunensis*, but we have no data to quantify the effects. On-going law enforcement activities at OPCNM have yet to affect plants and their habitat, but the human traffic and associated use of trails, changes in drug smuggling routes, and associated law enforcement activities to control these activities, may cause the loss or modification of *E. erectrocentrus* var. *acunensis* habitat in the future. In addition, current restrictions on access to *E. erectrocentrus* var. *acunensis* and habitat for management to prevent encroachment by exotic grasses threaten the habitat with modification by the grasses and

threaten the cacti and habitat with destruction by subsequent wildfire.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

Illegal collection has been cited as a threat to *Echinomastus erectocentrus* var. *acunensis* (Phillips et al 1982, p.9). Phillips and Buskirk (1982, p. 2) noted that there was no overt collection of plants on their monitoring plots, although they found some excavations nearby that could have been sites where plants were dug up. Buskirk and Phillips (1983, p.1) refer to some cactus collection by humans, but refer to it as “relatively uncommon and unsystematic” at present. In OPCNM, the plants are located adjacent to Puerto Blanco Drive, which used to be a scenic loop drive. That road is now closed to visitors, making it highly unlikely that collection is an on-going issue. No documented cases of illegal theft of this cactus have been found in any of the populations.

C. Disease or predation.

The population in OPCNM has the longest history of monitoring. Holm (2006) summarized the history of the monitoring plots. There has been a documented decline in the number of individuals on all six of the plots. Major declines were detected in the late 1970's, early 1980's and late 1990s (Holm 2006, p. 2-2). The highest annual mortality is greatest for the smallest plants (Holm 2006, p. 2-2). The pronounced decline in *Echinomastus erectocentrus* var. *acunensis* numbers from 1988-2005 is a serious concern for OPCNM managers. No single factor has been found to explain the declines. It is likely related to precipitation patterns, as high seedling mortality was noted after low rainfall periods (Holm 2006, p. 2-3). Currently, only 23 plants remain on these plots, down from a high of 446 in 1991. As noted in the status section above, in 1996, there was a high mortality event associated with many live, reproductive plants found uprooted and lying on the ground. There has been no explanation for this episode, which was also observed in the Coffeepot Mountain population and in the populations around Ajo (Rutman 2007, p. 3). However, there have been various hypotheses including vandalism, thrashers (birds) digging them up, and javelinas uprooting the plants, but there is no information linking these sources to the mortality. Another source of mortality for these plants is insects. Rutman (2007, p. 6) summarized a phone conversation with Zimmerman, who suggested that *Echinomastus* species have little or no chemical defenses against insect parasitism because it is an ancient genus. Zimmerman believes the cactus weevil (*Gerstaeckeria* sp.) and the black cactus borer (*Moneilema* sp.) were responsible for *E. erectocentrus* var. *acunensis* declines. He further stated that parasitism rates may be increasing because of increased warming, facilitating longer breeding cycles for the insects. Johnson (1991, p. 10) collected *Moneilema gigas* from *E. erectocentrus* var. *acunensis*. The larvae of these cactus borers consume the fleshy interior of the plants and often sever the root and stem, causing the plant to fall over, and because of this the larvae could cause substantial mortality to large *E. erectocentrus* var. *acunensis* (Johnson 1991, p. 10). Johnson (1992, p. 405) also noted that there was seed predation by the moth larvae, *Yosemitta graciella*, accounting for a reduction in seed set of 35 percent. Holm (2006, p.2-3) also thought that small mammals may pose a threat to the species. Buskirk (1982, p. 2) also alluded to small mammal predation on plants as a possible cause of observed mortalities. It is unknown if these same factors are affecting the other populations, but based on observations of declines in the Coffeepot Mountain area and the large number of cactus carcasses observed on the BLM monitoring plots there, on Mineral Mountain, and in the Florence area (Service 2007 and 2008b, p. 1), it is assumed that similar effects are occurring across the range. Disease is not

a factor that is known to threaten *E. erectocentrus* var. *acunensis*.

D. The inadequacy of existing regulatory mechanisms.

*Echinomastus erectocentrus* var. *acunensis* is protected by Arizona Native Plants law and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). However, CITES does not regulate take or domestic trade. Also, the remoteness of most of the cactus populations makes enforcement of the existing regulatory mechanisms very difficult. Most of the plants on OPCNM are now in areas closed to public vehicle traffic. The BLM sites are fairly remote and access is by 4-wheel drive only. Populations in Florence are easily accessible, but there does not appear to be many visitors to the area (Service 2008b). This species is protected (restrictions on collection) by the Arizona Native Plant Law, which prohibits collection without obtaining a permit, and plants may not be moved off of private property without contacting the Arizona Department of Agriculture. The Arizona Native Plants law does not offer much protection for the plant or its habitat; it merely permits the salvage of the plants if they are being moved off of private property. An individual can destroy the plants on their private property (or move them to a different location on their private property) without notifying the Department of Agriculture. In Mexico, there are no regulatory mechanisms in place to protect *E. erectocentrus* var. *acunensis* or its habitat. Therefore, we consider the lack of regulatory mechanisms to be a threat to *E. erectocentrus* var. *acunensis* the acuña cactus throughout its range.

E. Other natural or manmade factors affecting its continued existence.

Data from the monitoring plots on OPCNM show a significant decline in the number of plants within the plots. Currently, there are only 23 plants left in the plots, a loss of 95 percent since 1991. The BLM plots have not been read since the early 1990s, but periodic visits to the plots have shown continued mortality with little to no recruitment (Service 2007, p. 1). It is not clear what the factors are that are contributing to this decline. However, a series of dry years have likely contributed to both the decline and the lack of reproduction. Johnson et al (1992) determined that seedling survival was dependent on summer precipitation. Johnson (1992, p. 405) concluded that the positive association of rainfall and annual variation in the number of flowers produced indicates that water availability limits flower production in this species. Rainfall has been declining at OPCNM (Holm 2006, p. 2-13), especially winter (October–March) precipitation. There have also been some years when summer precipitation was below average (1900, 1992, 2001, and 2003); likely influencing seedling survivorship (Holm 2006, p. 2-13). There was no winter precipitation in 2001. It suggests that a seed bank is no longer present in the area and that the population has passed a critical threshold for remaining viable. Increasing aridity and the real possibility of long-term drought are predicted for the southwest (Seager et al 2007, p. 1183) with unknown long-term effects on *Echinomastus erectocentrus* var. *acunensis* populations. We believe that the declines in OPCNM are serious, and that continued declines will lead to the extirpation of the population at OPCNM. Lacking specific monitoring information for the other populations, it is assumed that they will be affected in similar ways as the OPCNM populations since their habitat is similar and they will be affected by the same regional increase in aridity.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED: In 1992, Johnson published work on the reproductive and pollination ecology of *Echinomastus erectocentrus* var.



*acunensis* (Johnson 1992). Results from this work suggest that water availability limits flower production (i.e., higher winter rainfall positively correlates with more flowers). This species is an obligate outcrosser and cannot pollinate itself. The identified pollinators were *Diadasia rinconis* and *Megachile palmensis*, small solitary bees that commonly pollinate many cacti species in the desert. In 1998, Johnson was funded by the Service to undertake a study of the demography and population dynamics of *E. erectocentrus* var. *acunensis* (results discussed under Factor E). The study was completed in 1999. We have funded, through our section 6 program, a taxonomic (morphology) study for 2006 of this variety and *E. erectocentrus* var. *erectocentrus*, known from Pima County. We have reviewed the completed study (Baker 2007) and conclude that the varieties, as currently described, are valid. Survey work for this taxon in Sonora, Mexico was funded through our section 6 program in 2008, but results are not yet available.

**SUMMARY OF THREATS:** The populations at OPCNM, and, likely the other populations, have been affected by the continuing drought, which has been on-going for at least the last six years. The populations at OPCNM have also been affected by some event which removed a large number of reproductive members from the population. There has been a documented decrease in adult survivorship and little to no recruitment of seedlings within the OPCNM population, which may also be occurring in the other populations. This significant decline, which we believe has been influenced by a variety of factors (predation and increased aridity), poses the greatest threat to the populations. Plants and habitat in OPCNM also may be affected by on-going undocumented immigrant traffic and drug smuggling, and associated law enforcement activities. Trails (foot and vehicle), and off-road driving can degrade habitat and possibly kill plants if they are run over. Invasive grass species may modify the habitat by introducing fire into ecosystems that are not resilient, modifying the habitat in such a way to eliminate *E.s erectocentrus* var. *acunensis*. Direct mortality to the plants would occur as a result of fire. In addition, populations on State and private land in the Florence area (Pinal County) may be affected livestock grazing practices, which may modify the habitat for germination and kill plants by knocking them over.

We find that this sub-species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

#### RECOMMENDED CONSERVATION MEASURES

This species would benefit from additional survey work in the U.S. and Mexico, quantification of habitat across the range, a systematic survey throughout the Florence area, maps with delineated habitat, and sustained monitoring across the range. We funded a section 6 project in 2008 to assess the status of this species in Mexico, but, due to contract delays, the work is not yet completed.

For species that are being removed from candidate status:

\_\_\_\_ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

## LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
<b>High</b>	<b>Imminent</b>	Monotypic genus	1
		Species	2
		<b>Subspecies/population</b>	<b>3*</b>
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

*Magnitude:* Populations of *Echinomastus erectocentrus* var. *acunensis* on OPCNM have shown an approximate 95 percent mortality in recent years. We are not able to quantify the decline in other populations on BLM, State, and private lands, but believe that their populations are also experiencing declines, since similar factors, such as continuing drought, are prevalent across the southwest. The reason(s) for the mortality are not known, but drought conditions, low seedling recruitment and survivorship, insect predation on plants and seeds, are thought to play a role. Habitat for this species within OPCNM may be affected by the spread of non-native species. Law enforcement activities may affect populations by degrading habitat from vehicular use and the creation of illegal trails through suitable habitat. Due to the decline in numbers where the majority of the plants exist (OPCNM and BLM lands), we believe that the magnitude of the threats is high.

*Imminence:* As discussed above, the populations are experiencing a decline in numbers. The monitoring data suggest that germination and survival of young plants has been very low. Continuing drought conditions, predation, and other natural factors are contributing to the decline, and possibly, the low reproductive output of the populations. Other anthropogenic factors are affecting resources in OPCNM, but have not yet affected the populations. Threats of on-going urban development appear to be affecting populations of this species in Ajo, Arizona, and Mexico, and could potentially affect populations in Pinal County. Drought, along with other factors discussed in Factors C and E, are currently affecting the populations known from OPCNM and suspected to be affecting the populations in Coffee Mountain and near Florence. The drought is widespread in southern Arizona and we have no reason to believe that the other populations outside of OPCNM would not be affected in a similar manner, with reduced

reproductive output and low to no recruitment. Based on this, we feel that the threats are imminent. In using a consistent definition of imminence we believe that the effects of prolonged drought, in conjunction with other factors discussed above, evidenced throughout the range of this species is adversely affecting the populations, and poses a significant threat beyond the other threats described here.

X Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed? Yes

Is Emergency Listing Warranted? No. We do not anticipate that the species is in danger of immediate extirpation.

DESCRIPTION OF MONITORING: All of the monitoring information was discussed under the status of the species and Factors C and E. In summary, the species is experiencing significant declines in OPCNM, and likely the other populations are experiencing declines, but we do not have the data to support this assumption. We will not be able to monitor the population in OPCNM on a regular basis, due to law enforcement restrictions, and that will make it difficult to quantify the population status or carry out conservation efforts.

#### COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: None

Indicate which State(s) did not provide any information or comments: Within the United States, the species only occurs in Arizona, and the Arizona Department of Agriculture (the agency that manages plants in the State) reviewed this document and had no comment. This species is not in Arizona's Comprehensive Wildlife Plan because the Arizona Department of Game and Fish has no authority to manage plants.

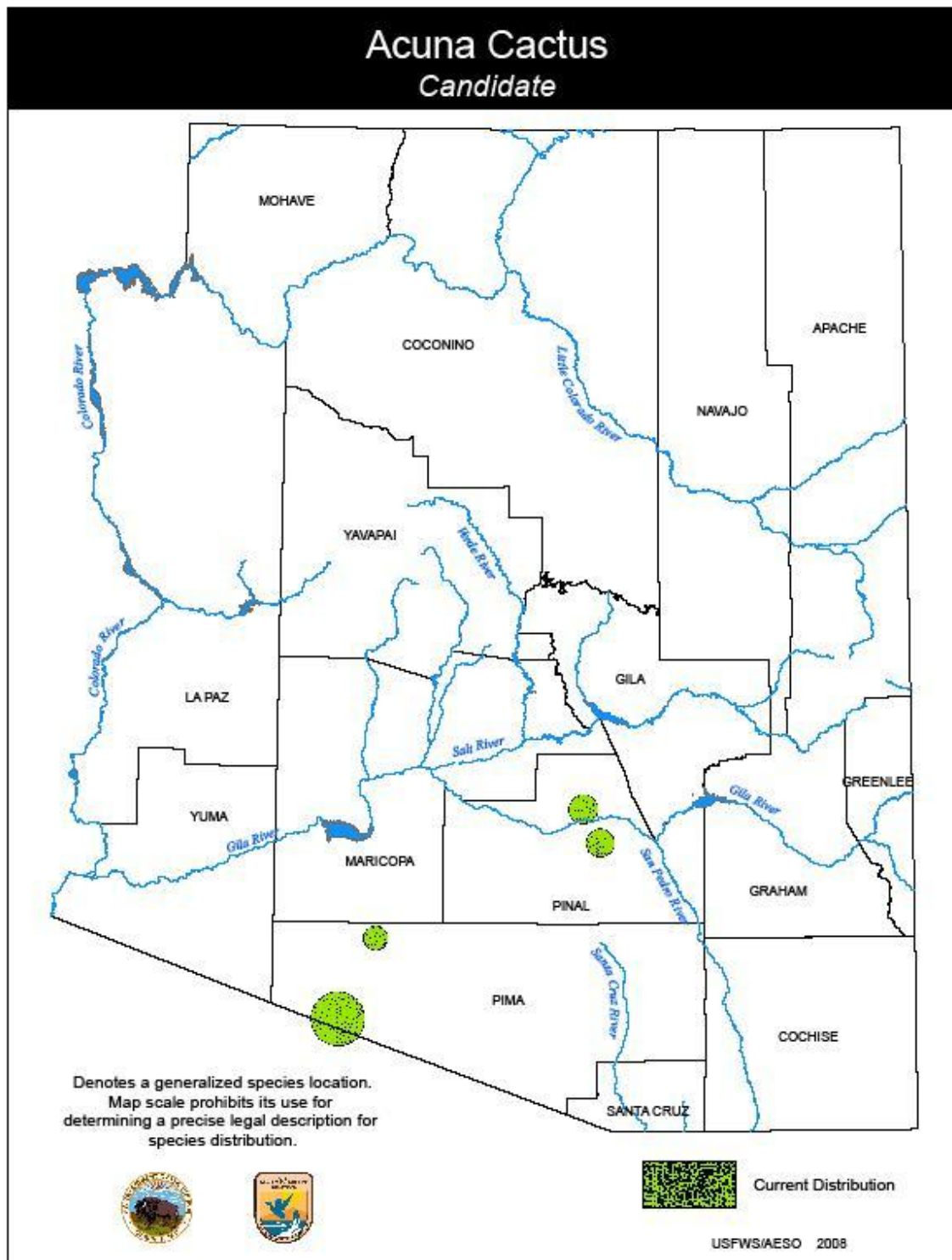


Figure 1. Distribution of Acuna cactus.

## LITERATURE CITED

- Arizona Game and Fish Department. 2004. *Echinomastus erectocentrus* var. *acunensis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 7 pp.
- Arizona Rare Plant Committee. 2001. Arizona rare plant field guide.
- Baker, M. 2007. A comparison of morphology among populations of acuña cactus, *Echinomastus erectocentrus* (J. M. Coulter) Britton & Rose var. *acunensis* (W.T. Marshall) H. Bravo and its relatives: *E. erectocentrus* var. *erectocentrus*, and *E. johnsonii* (Parry ex Engelm.) E. M. Baxter. Unpublished report submitted to USFWS. 22 pp.
- Breslin, P. 2008. E-mail correspondence to S. Rutman detailing location information for acuña cactus near Florence, Arizona dated 2-25-2008.
- Bureau of Land Management. 1993. Copy of herbarium record for locations of acuña cactus in the Mineral Mountains. 2 pg.
- Butterworth, C. 2008. E-mail to M. Falk (USFWS) detailing survey and location information for acuña cactus near Florence, AZ. dated 3-17-2008.
- Búrquez-Montijo, A, M.E, Miller, and A. Martínez-Yrizar. 2002. Mexican grasslands, thornscrub, and the transformation of the Sonoran desert by invasive exotic buffelgrass (*Pennisetum ciliare*) in Invasive Exotic Species in the Sonoran Region, B. Tellman, ed. The University of Arizona Press and the Arizona-Sonora Desert Museum, Tucson, AZ. pp. 126-146.
- Felger, R.S. 2000. Flora of the Gran Desierto and Rio Colorado of Northwestern Mexico. The University of Arizona Press, Tucson, Arizona. 651 pp.
- Johnson, R.A. 1989. Letter to U.S. Fish and Wildlife Service dated November 11, 1989.
- Johnson, R. A. 1991. Reproductive ecology and natural history of Acuna cactus, *Echinomastus erectocentrus* var. *acunensis*. Final Report submitted to Southwest Parks and Monuments Association and the National Park Service. 29 pp.
- Johnson, R.A. 1992. Pollination and reproductive ecology of acuña cactus, *Echinomastus erectocentrus* var. *acunensis* (Cactaceae). International Journal of Plant Science. 153(3): 400-408.
- Johnson, R.A., M.A. Baker, D.J. Pinkava, and G.A. Ruffner. 1992. Seedling establishment, mortality, and flower production of the acuña cactus, *Echinomastus erectocentrus* var. *acunensis* (Cactaceae) in Southwestern Rare and Endangered Plants, Sivinski and Lightfoot, eds. New Mexico Forestry and Resources Conservation District, Miscellaneous Publications No. 2. 170-180.

Holm, P. A. 2006. Acuña cactus (2006-2007). Pages 2-1 to 2-14 in Organ Pipe Cactus National Monument. Ecological Monitoring Report 2006-2007. Unpublished final report. Organ Pipe Cactus National Monument, Ajo, AZ.

Heil, K.D. and B. Melton. 1994. Status report for *Echinomastus erectocentrus* (J.M. Coulter) Britton & Rose var. *acunensis* (W. T. Marshall) H. Bravo-H. Unpublished report, Bureau of Land Management, Phoenix District Office, Arizona. 59 pp.

Marshall, W.T. 1953. Saguaroland Bulletin 7:33-34.

Phillips, A.M. and W. H. Buskirk. 1982. Status of the acuña cactus (*Neolloydia erectocentra* var. *acunensis*) and the Ajo Rock-daisy (*Perityle ajoensis*) in Organ Pipe Cactus National Monument, Arizona. Unpublished report. USFWS files. 7 pp.

Phillips, A.M., B.G. Phillips and N. Brian. 1982. Status report for *Neolloydia erectocentra* var. *acunensis*. Unpublished report, U.S. Fish and Wildlife Service. 14 pp.

Rutman, S. 1987. Trip report: Coffeepot Mountain Area, *Neolloydia erectocentra* var. *acunensis* populations, December 14-15, 1987. USFWS files. 2 pp.

Rutman, S. 1996. Letter to USFWS documenting the discovery of acuña cactus in Ajo. May 20, 1996. 4 pp.

Rutman, S. 2000. Email correspondence from Betsy Wirt (Luke Air Force Base) on the discovery of acuña cactus in the Sand Tank Mountains. 2pp.

Rutman, S. 2006. Report on acuña cactus populations, Ajo area and Saucedo Mountains, Pima County and Maricopa counties, Arizona. Unpublished report sent to U.S. Fish and Wildlife Service. 3 pp.

Rutman, S. 2007. Meeting Minutes, acuña cactus status discussion 28 August 2007. 19 pp.

Seager, R. *et al.* 2007. Model projections of an imminent transition to a more arid climate in Southwestern North America. Science 316: 1181

U.S. Fish and Wildlife Service. 2007. Field trip notes from visits to acuña cactus populations in Ajo and Coffeepot Mountains, Arizona. Files of USFWS. Tucson, AZ (June 19-20 2007). 1 pg.


U.S. Fish and Wildlife Service. 2008a. Field trip notes from visits to acuña cactus monitoring plots in Organ Pipe Cactus National Monument on March 27, 2008. Files of USFWS, Tucson, AZ. 1 pg.

U.S. Fish and Wildlife Service. 2008b. Field trip notes from visits to acuña cactus populations near Florence, Arizona. Files of USFWS. Tucson, AZ (March 20, 2008). 1 pg.

U.S. Fish and Wildlife Service. 2008c. Field trip notes from visits to acuña cactus populations on Mineral Mountain, Arizona. Files of USFWS. Tucson, AZ (September 10, 2008). 1 pg.

Zimmerman, A. and B.D. Parfit. 2003. Cactaceae. In Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 12+ volumes. New York and Oxford. Vol. 4, pp. 192-195.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  May 21, 2010  
Acting Regional Director, Fish and Wildlife Service Date

Concur:   
ACTING :  
Director, Fish and Wildlife Service Date: October 22, 2010

Do not concur: \_\_\_\_\_  
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: April 2010  
Conducted by: Mike Martinez